$$y_{error} = \frac{y_{act} - y_{ref}}{y_{ref}} \cdot 100\ \%$$

Eq. 1066.230-1

(2) *Ramping method.* You may set up an operator-defined ramp function in the signal generator to serve as the time standard as follows:

(i) Set up the signal generator to output a marker voltage at the peak of each ramp to trigger the dynamometer timing circuit. Output the designated marker voltage to start the verification period.

(ii) After at least 1000 seconds, output the designated marker voltage to end the verification period.

(iii) Compare the measured elapsed time between marker signals, y_{act}, to the corresponding time standard, y_{ref}, to determine the time error, y_{error}, using Equation 1066.230–1.

(3) *Dynamometer coastdown method.* You may use a signal generator to output a known speed ramp signal to the dynamometer controller to serve as the time standard as follows:

(i) Generate upper and lower speed values to trigger the start and stop functions of the coastdown timer circuit. Use the signal generator to start the verification period.

(ii) After at least 1000 seconds, use the signal generator to end the verification period.

(iii) Compare the measured elapsed time between trigger signals, y_{act}, to the corresponding time standard, y_{ref}, to determine the time error, y_{error}, using Equation 1066.230–1.

(d) *Performance evaluation.* The time error determined in paragraph (c) of this section may not exceed ±0.001%.

§ 1066.235 Speed verification procedure.

(a) *Overview.* This section describes how to verify the accuracy and resolution of the dynamometer speed determination.

(b) *Scope and frequency.* Perform this verification upon initial installation, within 370 days before testing, and after major maintenance.

(c) *Procedure.* Use one of the following procedures to verify the accuracy and resolution of the dynamometer speed simulation:

(1) *Pulse method.* Connect a universal frequency counter to the output of the dynamometer's speed-sensing device in parallel with the signal to the dynamometer controller. The universal frequency counter must be calibrated according to the instrument manufacturer's instructions and be capable of measuring with enough accuracy to perform the procedure as specified in this paragraph (c)(1). Make sure the instrumentation does not affect the signal to the dynamometer control circuits. Determine the speed error as follows:

(i) Set the dynamometer to speed-control mode. Set the dynamometer speed to a value between 4.2 m/s and the maximum speed expected during testing; record the output of the frequency counter after 10 seconds. Determine the roll speed, S_{act}, using the following equation:

$$S_{act} = \frac{f \cdot d_{roll} \cdot \pi}{n}$$

Eq. 1066.235-1

Where:

f = frequency of the dynamometer speed sensing device, in s^{-1}, accurate to at least four significant figures.

d_{roll} = nominal roll diameter, in m, accurate to the nearest 0.01 mm, consistent with §1066.225(d).

n = the number of pulses per revolution from the dynamometer roll speed sensor.

Example:

f = 2.9231 Hz = 2.9231 s^{-1}
d_{roll} = 904.40 mm = 0.90440 m
n = 1 pulse/rev

$$S_{act} = \frac{2.9231 \cdot 0.90440 \cdot \pi}{1}$$

S_{act} = 8.3053 m/s

(ii) Compare the calculated roll speed, $S_{act,}$ to the corresponding speed set point, $S_{ref,}$ to determine a value for speed error, $S_{error,}$ using the following equation:

$$S_{error} = S_{act} - S_{ref}$$

Eq. 1066.235-2

Example:

S_{act} = 8.3053 m/s
S_{ref} = 8.3000 m/s
S_{error} = 8.3053 − 8.3000 = 0.0053 m/s

(2) *Frequency method.* Use the method described in this paragraph (c)(2) only if the dynamometer does not have a readily available output signal for speed sensing. Install a single piece of tape in the shape of an arrowhead on the surface of the dynamometer roll near the outer edge. Put a reference mark on the deck plate in line with the arrow. Install a stroboscope or photo tachometer on the deck plate and direct the flash toward the tape on the roll. The stroboscope or photo tachometer must be calibrated according to the instrument manufacturer's instructions and be capable of measuring with enough accuracy to perform the procedure as specified in this paragraph (c)(2). Determine the speed error as follows:

(i) Set the dynamometer to speed control mode. Set the dynamometer speed to a value between 15 kph and the maximum speed expected during testing. Tune the stroboscope or photo tachometer until the signal matches the dynamometer roll speed. Record the frequency. Determine the roll speed, $y_{act,}$ using Equation 1066.235–1, using the stroboscope or photo tachometer's frequency for f.

(ii) Compare the calculated roll speed, $y_{act,}$ to the corresponding speed set point, $y_{ref,}$ to determine a value for speed error, $y_{error,}$ using Equation 1066.235–2.

(d) *Performance evaluation.* The speed error determined in paragraph (c) of this section may not exceed ±0.02 m/s.

§1066.240 Torque transducer verification and calibration.

Calibrate torque-measurement systems as described in 40 CFR 1065.310.

§1066.245 Response time verification.

(a) *Overview.* This section describes how to verify the dynamometer's response time.

(b) *Scope and frequency.* Perform this verification upon initial installation and after major maintenance.

(c) *Procedure.* Use the dynamometer's automated process to verify response time. Perform this test at two different inertia settings corresponding approximately to the minimum and maximum vehicle weights you expect to test. Use good engineering judgment to select